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Abstract

In this paper we analyze the link between homeownership and various aggregate and individual labour market outcomes. Our aim is to investigate the likely consequences of public policies that promote homeownership. To this end, we develop a circular firm-worker matching model with Nash wage bargaining and free market entry. Homeowners are assumed to be less mobile than tenants due to higher mobility costs mainly induced by housing market frictions. Through extensive numerical simulations, we show that: (1) Higher homeownership rates need not lead to higher unemployment rates, contrary to the so-called Oswald's hypothesis, but depends crucially on the importance of mobility costs mainly driven by housing market regulation; (2) while increased homeownership may prove harmful to some macroeconomic labour market indicators, it is always beneficial to individuals' labour market performances.

Keywords: Stochastic job matching, Homeownership, Unemployment, Mobility

JEL Codes: H31, J61, J64, R23

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1. Introduction

Over the past decades homeownership rates have increased significantly in many OECD countries. As stressed by Andrews and Caldera Sànchez (2011), only a part of this increase can be explained by changes in households' characteristics such as age, income, household structure or education. According to them, a significant part of this increase stems from the many programs and public policies that have been implemented over time to foster homeownership: subsidized loans, zero interest loans, smaller down payments, tax deductible mortgage interests, *etc.*

The rationale for subsidizing homeownership is manifold. Positive externalities in the form of increased health and fertility, lower crime rates, and increased community involvement are often associated with a higher rate of homeownership [see, e.g., Dietz and Haurin (2003) for a summary of the literature]. Yet, another strand of the literature has emphasized its potentially negative effects on the labour market. What is now conventionally referred to as "Oswald's hypothesis" or "Oswald's conjecture" suggests that higher homeownership rates may increase unemployment rates, thus partly explaining international and interregional variations in the latter.

Our paper aims at investigating Oswald's conjecture by formalizing the behavioural assumptions of his seminal contribution. Indeed, Oswald's conjecture stems from a macroeconomic empirical regularity but rests upon microeconomic behavioural assumptions (Oswald, 1996, 1999). His starting point is to reasonably assume that a loan must be contracted to buy a house. This long run financial constraint will very likely harm homeowners to a greater extent when unemployed. Second, because the sale or the purchase of a property entails very large transaction costs, owning a house certainly impairs geographic mobility on distant labour markets. The lower mobility of homeowners has been widely confirmed in the empirical literature [Smith et al., 1988; Hammnett, 1991; South and Deane, 1993; Rohe and Stewart, 1996; Henley, 1998]. Lower mobility inhibits search strategies and may translate into poorer match quality, thus giving rise to inefficiencies [Munch et al., 2006; Vuuren and Leuvensteijn, 2007]. In this particular case, lower mobility may translate into homeowners earning lower wage rates. Oswald also argues that homeowners are more willing to commute than tenants over longer distances which also leads to inefficiencies due to transport congestion. More recently, Blanchflower and Oswald (2013) argue that high homeownership rates deter business formation and, consequently, job opportunities through zoning restrictions (NIMBY pressures).

Many empirical studies have tested Oswald's conjecture using regional or cross-country data while others have tested related theoretical hypotheses (unemployment probability and duration) using micro-economic data [see Havet and Penot (2010) for a detailed survey]. No consensus has yet emerged in the literature. Macroeconomic analyses provide mixed results.[1] Most microeconomic analyses show that homeowners have lower probabilities of being unemployed and have shorter spells than tenants on local labour markets.[2] Interestingly, results are mixed when reemployment requires geographic mobility. Microeconomic studies have also underlined the importance of distinguishing between mortgaged and outright homeowners [Baert et al., 2014] and the need to account for search intensity on local and distant labour markets [Morescalchi, 2014]. However, most of these studies are plagued with methodological drawbacks. Indeed, many microeconometric analyses fail to account adequately for the endogeneity of homeownership and individual performances on the labour market so their conclusions need to be interpreted with caution.[3]

At the theoretical level, microeconomic stylized search models have been developed to investigate Oswald's hypothesis [Oswald, 1997; Munch et al., 2006; Dohmen, 2005; Coulson and Fisher, 2009; Vuuren, 2016]. They all consider an economy in which the labor market is split into a local and a distant component, and that only homeowners face mobility costs. Only Oswald (1997) considers the possibility that homeowners may commute between regions. Other papers implicitly assume that homeowners are constrained to their local labour market. Likewise, in most papers, save for Coulson and Fisher (2009), firms are not explicitly modeled thus omitting any effect of homeownership on job creation. Munch et al. (2006) distinguish between homeowners' performances and reservation wages on local and non local labour markets. Finally, Vuuren (2016) takes into account the decision of workers to become homeowners and, in particular, the risk of losing their house during a spell of unemployment.

[1] Nickell and Layard (1999) and Belot and Van Ours (2001) find a positive and significant impact of homeownership on unemployment rates in several OECD countries. However, when controlling for additional covariates such as lagged unemployment rate, money supply shocks and labour demand, Green and Hendershott (2001) no longer find any significant relationship for 19 OECD countries over the period 1961-1995. Coulson and Fisher (2009) (U.S.) and Garcia and Hernandez (2004) (Spain) find that an increase in homeownership rates lower the unemployment rate.

[2] Nearly all empirical studies on the probability of unemployment reject Oswald's arguments, whereas those on unemployment duration generate more controversial results [see Havet and Penot (2010) for details].

[3] For instance, it may be that the unemployment spells of homeowners are shorter than those of renters because they behave differently and, at the same time, workers with good job opportunities choose to become homeowners.

Most theoretical papers find that homeowners are more likely to be unemployed and to have longer unemployment duration except Munch et al. (2006) and Vuuren (2016) who find no link between homeownership and individual labor market performances. In Munch et al. (2006), even though homeowners are less mobile on the non local labor market (mobility effect), their lower reservation wages for local jobs more than compensate the aforementioned negative effects so that homeowners can have shorter unemployment duration. At the aggregate level, Oswald (1997) and Dohmen (2005) find that higher homeownership rates always lead to higher aggregate unemployment rates due to a composition effect of unemployed workers. Munch et al. (2006) find that the correlation can be positive if the negative mobility effect dominates. Finally, Coulson and Fisher (2009) find a non monotonous correlation when taking into account firms' behaviour. Unlike Blanchflower and Oswald (2013)'s argument, they show that higher homeownership rates stimulate firm entry (entry effect) and job opportunities so as to overcome the negative composition effect of unemployed workers on aggregate unemployment. Unfortunately, housing market frictions are omitted in the literature, even though it can impact homeowners geographic mobility. Head and Lloyd-Ellis (2012) have proposed a model in which homeownership affects labour market outcomes because the price of houses, which reflects their liquidity, affects homeowners geographic mobility. However, contrary to previous models, their analysis focuses on the functioning of the housing market and workers' location choices. Search behaviour and search frictions in the labour market are somewhat sidestepped to make the model tractable. When calibrated to match U.S data, it predicts that homeownership has little impact on aggregate unemployment. High homeownership rates matter more only in high unemployment economies.

In our paper, we investigate whether public policies that promote homeownership are beneficial at the aggregate and/or individual levels. We do so by investigating the consequences of simultaneously varying homeownership rates and housing market frictions. To this end, we develop a stochastic job matching model *à la* Pissarides (2000) in which wage determination results from bargaining between firms and workers as in Coulson and Fisher (2009). As in previous papers, we also assume that homeowners are less mobile than tenants on distant labour markets due to mobility costs. However, we transposes the analysis of Salop (1979) to that of workers' geographic mobility and consider a continuum of heterogeneous distant labour markets rather than a single one. More distant labor markets impede mobility as they involve greater costs. Furthermore, in a more stylized manner than in Head and Lloyd-Ellis (2012), we also allow the housing market to impact labour market through an effect on homeowners mobility cost. Lastly, as in Vuuren (2016), we consider that the unemployment utility of homeowners is lesser that of tenants due to their risk of losing their property during an unemployment spell.

The model is parameterized and numerous simulations are conducted. As in many previous models, simulations show that tenants always outperform homeowners on the overall labour market in terms of wage, exit rates from unemployment and unemployment probability. As in Coulson and Fisher (2009), we find that workers' performances always improve following a policy that promotes homeownership due to its positive effect on job creation. Nevertheless, the simulations also show that the aggregate unemployment rate generally increases following such a policy, although Oswald's conjecture is mitigated and even reversed as the housing market gets more efficient. Thus, our results support policies that foster homeownership provided that adequate public policies on housing market cancel out its negative effect on the labour market.

The paper is organized as follows. The next section presents the theoretical framework. We underline and motivate the main assumptions of the model. In Section 3 we derive the steady-state equilibrium of the model. In Section 4 we calibrate the model and report the simulation results on numerous outcomes of exogenously increasing the share of homeowners and the extent of housing market frictions. We conclude the paper in Section 5..

2. The model

We propose a theoretical framework *à la* Pissarides (2000) aimed at evaluating the impact of residential status *per se* on individual and aggregate labour market performances through its effect on geographic mobility. Our focus is on the steady-state equilibrium. Time is continuous and the economy is populated by a continuum of risk-neutral, infinitely-lived agents who share a common discount factor ρ. We assume workers and firms to be uniformly distributed along a directed circle whose circumference is normalized to unity.[4] Firms are identical save for their exogenous location on the circle; they are all endowed with a single vacancy, and when a match occurs, the firm produces with a fixed coefficient technology requiring one worker to produce y + ε units of output. In this setup, y is common to

[4]The use of a directed circle makes the model more tractable and allows interpretations in terms of mobility rates. Furthermore, by assuming uniformly distribution of identical workers and firms, we abstract from location decisions.

all firms while ε is match-specific, unknown before the match occurs, and drawn from a stationary distribution G with support $[0; +\infty[$, assumed to be common knowledge.

Workers differ in their location on the circle and in their residential status. Residential status matters because finding a job takes time and is costly, and workers may find jobs that are located far from their place of residence. Workers' willingness to accept job offers at different locations depends on mobility costs as well as on expected gains.

2.1. Residential status and mobility cost

Workers are constrained in their search by virtue of their residential status which entails different mobility costs. Each worker can either be a homeowner, h, or a renter, r. The exogenous share of homeowners is denoted by $\mu_h = \mu$ and that of tenants by $\mu_r = 1 - \mu$. [5] The economy is represented by the directed circle in Figure 1. Each point on the circle corresponds to a local labour market. All local labour markets are assumed identical so that the situation at a specific point corresponds to the state of the economy.

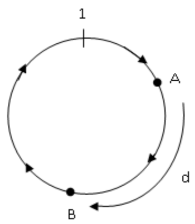


Figure 1: Our economy

As shown in the figure, a worker located at A has to move to accept a job offer in the distant labour market located at B, *i.e.* at a distance $d \in [0; 1]$. This move entails a cost that differs between homeowners and tenants. For simplicity, we assume that only homeowners bear a mobility cost. Tenants are perfectly mobile and can move freely to any job on the circle. The mobility cost is a function of the state of the housing market, λ, and the distance, d:

$$Cm(d) = \frac{d}{\lambda}, \tag{1}$$

where $\lambda \in]0; 1]$ is an efficiency index of the housing market. Here we consider that efficiency

[5] As we focus our analysis on the effects of homeownership policies, we simplify our model by considering exogenous tenure choices. Indeed, as Andrews and Caldera Sànchez (2011) showed, such policies bring about changes in homeownership rate without any changes in households' characteristics.

means a frictionless market with costless trading. As λ nears one the housing market becomes more efficient in that it is easier and less costly for homeowners to sell their house and buy a new one. Thus λ proxies both transaction costs (*i.e.* intermediaries, taxes, *etc.*) and market liquidity (*i.e.* the rate at which a dwelling can be transferred between homeowners). More generally, we argue as in Ruppert and Wasmer (2012), that there exists a positive relationship between regulation and frictions on the housing market. As a consequence, more regulation translates into a less efficient housing market, and thus higher mobility costs, so that housing policies can affect homeowners' job search behavior and overall labour market outcomes. When $\lambda = 1$, mobility costs are commensurate to distance. We assume they are increasing with the distance, d, because search and psychological costs of moving are increasing with distance.

2.2. Unemployment, vacancies and matching frictions

A worker can be either employed or unemployed. Only unemployed workers are assumed to search and eventually receive job offers (no on-the-job search). As in Pissarides (2000), search is random, and vacant jobs and unemployed workers are brought together in pairs by a customary matching function which relates the number of matches in the market to the total number of job seekers and vacancies, *i.e.*

$$M \equiv m(u; v),$$

where u and v correspond to the number of job seekers and the number of vacancies, respectively. The function is assumed to be twice continuously differentiable (C^2), increasing and concave in both its arguments, linearly homogeneous, and to satisfy the Inada and the boundary conditions: $m(0; v) = m(u; 0) = 0$ for $u, v \geq 0$. On average, a firm contacts a worker at rate M/u while a job seeker meets with a firm at rate M/v. Let $\theta = v/u$ be the labour market tightness. Linear homogeneity of the matching function allows us to write the contact rates as $M/v = q(\theta)$ and $M/u = \theta q(\theta)$. Contact rates, $q(\theta)$ and $\theta q(\theta)$, are respectively decreasing and increasing functions of θ. The total number of job seekers in the economy, u, consists of unemployed homeowners, u_h, and unemployed tenants, u_r:

$$u = u_h + u_r. \tag{2}$$

As unemployed tenants can move without cost, they receive job offers from the whole circle ($d_r = 1$). Thus, they meet vacancies at rate:

$$\int_{j \in [0,1]} \theta_j q(\theta_j) dj = \theta q(\theta). \tag{3}$$

Unemployed homeowners, on the other hand, bear a mobility cost too high to search and meet job offers located beyond a critical distance $\bar{d} \in [0, 1]$. Consequently, they meet vacancies at a lower rate than tenants:

$$\int_{j \in [0,\bar{d}]} \theta_j q(\theta_j) dj = \bar{d}\theta q(\theta) \leq \theta q(\theta). \tag{4}$$

This critical distance, $\bar{d} \leq 1$, varies according to the mobility cost and corresponds to the distance from which an unemployed homeowner prefers to stay unemployed instead of moving to a new job.

2.3. Gains to Firms and Workers

Value functions are defined as follows. Let W_i and U_i be the present discounted value (PDV) of the expected income stream of an employed and an unemployed worker with residential status $i = h, r$, respectively. Similarly, let J_i be the PDV of the expected profit from filling a job with a worker with residential status i, and V the PDV of a vacancy.

2.3.1. Workers

The value of being employed, $W_i(\varepsilon)$, or unemployed, U_i, for a type $i = h, r$ worker satisfies

$$\rho W_i(\varepsilon) = w_i(\varepsilon) - \delta \left[W_i(\varepsilon) - U_i \right]. \tag{5}$$

$$\rho U_i = b_i + d_i \theta q(\theta) \int_0^{+\infty} \max \left[W_i(\varepsilon) - U_i, 0 \right] dG(\varepsilon). \tag{6}$$

A worker i receives a wage, $w_i(\varepsilon)$, when employed and has a constant reservation utility b_i when unemployed. Job destruction occurs at an exogenous Poisson rate δ in which case a worker incurs a loss equal to $W_i(\varepsilon) - U_i$. A job seeker receives an offer at rate $d_i\theta q(\theta)$, which depends on his residential status. The offer is accepted if it yields a positive expected gain.[6]

[6] Recall that $d_r = 1$ and $d_h = \bar{d} < 1$.

While searching, the worker has a reservation utility level, b_i, that corresponds to unemployment benefits, housing benefits or unpaid leisure activity. This parameter is key to determine which type of job seeker (e.g. homeowner or tenant) has the largest reservation wage ρU_i. Such a reservation wage can vary according to the agents' status on the housing market for several reasons, and opposite effects can be at stake. For instance, mortgage-free homeowners are not entitled to publicly provided housing benefits as opposed to tenants. On the other hand they derive more utility from leisure than mortgaged homeowners as the latter may have to sell their property if the unemployment spell lasts too long. Similarly, homeowners may derive more utility from leisure but may find it more difficult to adjust their housing consumption. We thus assume that $b_h < b_r$, and as a consequence, even in case of perfect mobility ($d_h = d_r = 1$), unemployed homeowners have a lower reservation utility than unemployed tenants. This assumption is consistent with Oswald's argument according to which owners are always disadvantaged when unemployed due to their lower ability to adjust their housing consumption. Furthermore, it also accounts for the fact that homeowners may lose their assets in case of a long lasting unemployment spell (Vuuren, 2016).

2.3.2. Firms

The PDV of a filled job, $J_i(\varepsilon)$, satisfies

$$\rho J_i(\varepsilon) = y + \varepsilon - w_i(\varepsilon) - \delta\left[J_i(\varepsilon) - V\right]. \tag{7}$$

A job filled with a worker with residential status i produces $y + \varepsilon$ and yields a wage $w_i(\varepsilon)$. The job can be destroyed at an exogenous Poisson rate δ, in which case the firm incurs a loss equal to $J_i(\varepsilon) - V$.

The PDV of a vacant job satisfies

$$\rho V = -c + q(\theta)\left\{\phi \int_0^{+\infty} \max\left[J_h(\varepsilon) - V, 0\right] dG(\varepsilon) + (1-\phi)\int_0^{+\infty} \max\left[J_r(\varepsilon) - V, 0\right] dG(\varepsilon)\right\}, \tag{8}$$

where ϕ stands for the share of unemployed who are homeowners, and is given by $\phi = \frac{u_h}{u_h + u_r}$. Thus, the value of a vacant job is equal to the expected gain from hiring which occurs at rate $q(\theta)$ minus the cost of keeping the job vacant. As matching is random, the firm can either hire a homeowner or a tenant, so that the gain from hiring is a weighted average, the weights depending on the respective shares of homeowners and tenants in the pool of job seekers.

2.4. Surpluses and Nash Bargaining

The surplus of a match between a firm and a worker i with a productivity ε, $S_i(\varepsilon)$, can be written as

$$S_i(\varepsilon) = [J_i(\varepsilon) - V] + [W_i(\varepsilon) - U_i]. \tag{9}$$

It is equal the sum of the net gains to the firm and to the worker i for a given match. In equilibrium, free entry in the for-hire labour market drives rents from vacant jobs to zero, $V = 0$. Indeed, firms are assumed to search actively until the expected profit of hiring equals to its cost, *i.e.* until all rents are exhausted. Consequently, the surplus of a match can be rewritten as

$$S_i(\varepsilon) = J_i(\varepsilon) + [W_i(\varepsilon) - U_i]. \tag{10}$$

The negotiated wage results from a Nash bargaining between the firm and the worker. The match surplus is shared between them to satisfy the following sharing rule:

$$W_i(\varepsilon) - U_i = \frac{\beta}{(1-\beta)} J_i(\varepsilon), \tag{11}$$

where β and $(1-\beta)$ represents the bargaining power of workers and firms, respectively.

2.5. Decision Rules

The firms and the workers' decision rules determine job acceptance, the reservation productivity on the local labour market as well as the maximum distance homeowners are willing to move.[7]

Not all matches between firms and workers are profitable. Indeed, there exists a common reservation productivity $y + R_i$ below which neither the firm nor the worker i wants the match to become effective. In other words, R_i represents the match-specific reservation productivity from which the match surplus becomes positive $S_i(R_i) \geqslant 0$. Thus, in each

[7]Notice that search efforts have been omitted here, mainly for the sake of simplicity. One may keep in mind that the return to search depends on workers willingness to accept distant jobs (i.e. the critical distance d_i) as on the reservation productivity R_i. As a result, homeowners and renters may have different search intensities. This could be another channel through which homeownership may affect labour market outcomes.

local labour market, the reservation productivity R_i below which a match is rejected results from

$$S_i(R_i) = 0. \tag{12}$$

By analogy to Ruppert and Wasmer (2012), R_i also reflects the willingness to commute by each worker.[8] The smaller R_i is, the more a worker is willing to commute to stay in his local labour market.

The critical distance $\bar{d}$ above which homeowners are better off staying unemployed rather than moving in a distant labour market is implicitly defined as:

$$C_m(\bar{d}) = \int_{R_h}^{+\infty} W_h(\varepsilon) dG(\varepsilon) - U_h. \tag{13}$$

3. Steady State Equilibrium

The steady-state equilibrium of our economy is given by the 8-tuple $\left(u_h^*, u_r^*, \theta^*, R_h^*, R_r^*, w_h^*(\varepsilon), w_r^*(\varepsilon), \bar{d}^*\right)$ which is solution to the following equations: reservation productivity equations, wage curves, labour market flow equations, job creation curve, critical distance equation. They are defined in this section.

3.1. Reservation Productivity

A random match between a firm and a worker becomes effective if and only if the match-specific productivity is such that $\varepsilon \geqslant R_i$, which occurs with a probability $[1 - G(R_i)]$. From the Bellman equations (7), and (6), and equations (10) and (12), we have

$$R_i = \rho U_i - y. \tag{14}$$

Thus, the reservation productivity of a match between a firm and a worker i is equal to the difference between the value of being unemployed and the minimum productivity of a match (*i.e.* when $\varepsilon = 0$). As unemployed homeowners' utility is lower, they are more willing to accept low productive matches, $R_h \leqslant R_r$, and longer commute to stay in

[8] Indeed, we can consider that R_i is inversely related to the largest commuting distance that a worker is willing to undertake.

their local labour market. Moreover, according to equations (10) and (14), and using the reservation productivity equation (12), $S_i(R_i) = 0$, we have

$$S_i(\varepsilon) = \frac{\varepsilon - R_i}{\rho + \delta}. \tag{15}$$

Thus, the lower the unemployed worker's utility is, the larger the surplus of the match. Likewise, the higher the reservation productivity of a worker is, the lower the match surplus. Consequently, we can expect that hiring a homeowner will be more profitable for a firm than employing a tenant.

3.2. Wages

Given the free entry condition $V = 0$, and equations (6), (7) and (11), the wages can be written as a weighted average between the workers' outside options, determined by ρU_i, and their productivity, $y + \varepsilon$, and are thus given by

$$w_i(\varepsilon) = \beta(y + \varepsilon) + (1 - \beta)\rho U_i \tag{16}$$

where $i = h, r$. As $\rho U_h \leqslant \rho U_r$, equation (16) implies that a homeowner will earn on average a lower wage than a tenant at given productivity.

3.3. Job Creation

Given the free entry condition, the surplus sharing rule (11), the reservation productivities R_i implied by (14) and the surplus in (15), we can derive from (8) the following job creation curve:

$$\frac{c}{(1-\beta)q(\theta)} = \phi \int_{R_h}^{+\infty} S_h(\varepsilon)dG(\varepsilon) + (1-\phi)\int_{R_r}^{+\infty} S_r(\varepsilon)dG(\varepsilon). \tag{17}$$

This expression corresponds to a marginal condition of labour demand. Indeed, new jobs are posted until the expected cost of a vacancy equals the expected gain from a filled one. As previously stated, hiring a homeowner will be more profitable for a firm than hiring a tenant. Consequently, we can infer from equation (17) that firms will open more vacancies if homeowners are more numerous in the labour force.

3.4. Labour Market Flows

Because only matches with a productivity $\varepsilon \geqslant R_i$ become effective, which occurs with a probability $P(\varepsilon \geqslant R_i) = [1 - G(R_i)]$, the exit rates from unemployment are

$$q_i^w = d_i \theta q(\theta) \left[1 - G(R_i)\right]. \tag{18}$$

From these expressions, it turns out that the unemployment hazards depend on labour demand (θ), on the job seekers' mobility costs (d_i), and on their willingness to commute within a local labour market (R_i). Since $d_r = 1$, we expect tenants to have a higher unemployment exit rate unless the homeowners' willingness to commute (low R_h) compensates their lack of mobility on the distant labour markets ($\bar{d} < 1$).

In a steady state, unemployment rates are constant. The flow of type i -workers ($i = h, r$) being hired is thus equal to the flow of those who lose their job:[9]

$$d_i \theta q(\theta) \left[1 - G(R_i)\right] u_i = \delta \left(\mu_i - u_i\right),$$

so that

$$u_i = \mu_i \frac{\delta}{q_i^w + \delta}. \tag{19}$$

Thus, workers' unemployment rate is decreasing in the exit rate, q_i^w, and increasing in the job destruction rate, δ.

3.5. Critical Distance

Equation (13) relates the critical distance $\bar{d}$ to the mobility cost defined by equation (1) and to the worker's expected gain. Using the surplus expression (10) and the sharing rule (11), we can write

$$\begin{aligned} \bar{d} &= \lambda \left[\beta \int_{R_h}^{+\infty} S_h(\varepsilon) dG(\varepsilon) - U_h G(R_h)\right] \leqslant 1, \text{ or,} \\ \bar{d} &= \lambda \left\{\beta [1 - G(R_h)] E[S_h(\varepsilon) | \varepsilon \geqslant R_h] - U_h G(R_h)\right\} \leqslant 1, \end{aligned} \tag{20}$$

[9]We assume that workers keep their residential status in case they become unemployed or decide to move.

where $G(R_h)$ gives the probability that $\varepsilon < R_h$. The critical distance above which homeowners will reject all job offers is decreasing in housing market regulation.[10] Moreover, homeowners will be less willing to move when expected gains from a suitable match are small, independently of labour market frictions. Note that in our framework, the critical distance can be interpreted as the mobility rate of homeowners in our economy.

4. Numerical Simulations

In this section, we parametrize our model and conduct a set of simulations to investigate whether policymakers should encourage homeownership.[11] To this end, we analyze the effects of arbitrarily increasing the rates of homeownership and that of housing market efficiency on individual and aggregate labour market performances. We acknowledge that homeownership rates are likely endogenous. We ignore this in order to keep an already involved model tractable. In addition, our goal is to illustrate the long-term steady-state equilibria that are likely to be observed as different countries implement policies that promote homeownership and/or housing market efficiency.

4.1. Calibration

For a start, we have to specify the functional forms of the matching function and the match-specific productivity distribution. As in Pissarides (2000), we use a Cobb-Douglas matching function, $m(u; v) = u^{\eta} v^{1-\eta}$, where $\eta \in [0, 1]$ is the matching elasticity with respect to unemployment. In the empirical literature, wage distributions are commonly characterized by a log-normal distribution. We thus assume that the match-specific productivity ε also follows a log-normal distribution, `LogNormal(0,1)`, on the interval $[0, +\infty[$.

We parameterize our model on a monthly basis and the discount rate is appropriately set to 0.996, which corresponds to a 1.2% quarterly interest rate. As is common in the literature (see *e.g.*, Petrongolo and Pissarides, 2001), we assume the elasticity of matching function with respect to unemployment, η, and the bargaining power of workers, β, to be equal to 0.5. The exogenous job destruction rate is set to $\delta = 0.034$, which roughly corresponds to an average job life of 2.5 years. We normalize the minimal productivity of a match, y, to one. The vacancy cost, c, is set to 0.6, which more or less corresponds to 25%

[10] Recall that there exists an inverse relationship between mobility costs and housing market regulation.
[11] See the appendix for details about the simulated model.

Table 1: Parameters Values

Parameters	Symbols	Values
Discount rate	ρ	0.996
Matching function elasticity	η	0.5
Workers' bargaining power	β	0.5
Job destruction rate	δ	0.034
Minimal productivity of a match	y	1
Vacancy cost	c	0.6
Homeowners' reservation utility	b_h	0.9
Tenants' reservation utility	b_r	1.5

of the average productivity of a match in our economy.[12] We choose reservation utilities of homeowners and tenants so that b_h is equal to 60% of b_r and choose the value $b_h = 0.9$ and $b_r = 1.5$. Consequently, even if homeowners were assumed to be perfectly mobile, their permanent income when unemployed would still be lower.[13]

We solve the model over a grid in the $\mu \in]0; 100\%[\times \lambda \in]0.3; 1[$ space in order to gauge both the effects of homeownership rates and housing market efficiency on labour market outcomes.

4.2. Main steady-state effects

It can be shown that arbitrarily changing the proportion of homeowners[14] will have three broad effects: a composition effect, an entry effect and a competition effect.[15] The relative strength of each will determine the net impact on labour market outcomes of promoting homeownership. A change in the efficiency of the housing market, on the other hand, will be limited to the competition effect. Before we dwell into the simulation results, we discuss each effect in turn as they are key in understanding our results.

[12]Given the distribution of ε and the normalization of y, the average productivity of a match is given by $y + E(\varepsilon|\varepsilon > 0) \simeq 2.65$. Note that higher or lower values of c will not affect the qualitative results of our model.

[13]Note that the levels of b_h and b_r have no influence on the qualitative results, only the gap between them matters.

[14]In our model, such arbitrarily change can be involved by public policies that make homeownership access easier without change in workers' position.

[15]The first two are identical to those in Coulson and Fisher (2009).

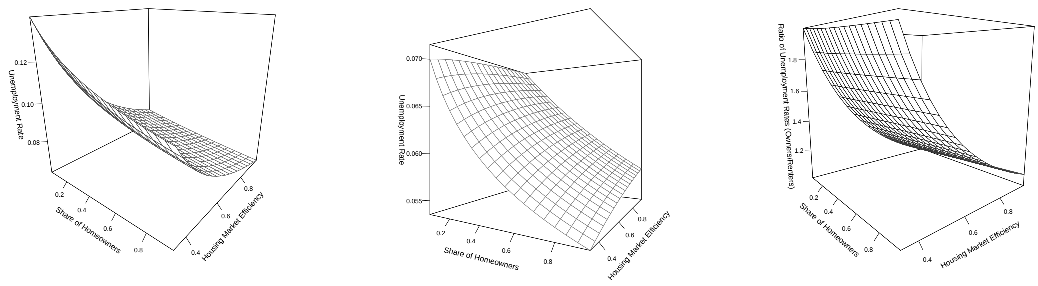
1. *Composition effect:* Increasing the share of homeowners in the economy will have a purely mechanical impact on aggregate performances. Indeed, if homeowners have better (worse) labour market performances than tenants, increasing their share will improve (worsen) aggregate labour market performances (see equations (2) and (19)).
2. *Entry effect:* Hiring a homeowner is usually more profitable for a firm since the resulting surplus is higher for a given match-specific productivity level (see equation (10)). Therefore, increasing the share of homeowners in our economy will increase firms' expected profits. This will induce new firms to enter the market and post new vacancies (see equation (17)). As a result, the labour market becomes tighter (θ increases) and firms' contact rate decreases whereas that of workers increases. Consequently, unemployment durations and the probability of being unemployed of all workers decrease (see equations (18) and (19)) because of the new job opportunities in each local labour market (and so in the economy as a whole).
3. *Competition effect:* This effect refers to the competition between unemployed workers on local and distant labour markets which affects their value to be unemployed so that all other outcomes will be affected *in fine*. Both homeownership rate and housing market efficiency have an effect on competition between unemployed workers.
   - *Competition effect on local labour market*: As homeowners are imperfectly mobile on distant labour markets, increasing their share will reduce the number of outside job seekers[16] in each local labour market. Indeed, perfectly mobile unemployed workers (renters) become proportionately fewer. Consequently, the competition between unemployed workers will be weaker on each local labour market which is more beneficial to unemployed renters (because of their perfect mobility).
   - *Competition effect on distant labour markets*: An improvement in the housing market efficiency will reduce mobility costs. Consequently, owners becomes more mobile and thus search in more distant labour markets. However, the competition between unemployed owners and tenants on distant labour markets strengthens at the expense of tenants.

[16] By *outside job seeker* we mean an unemployed worker which is initially located outside of the local labour market.

Clearly, the relative labour market outcomes of two economies who only differ in terms of their relative share of homeowners will depend on the relative strength of the above effects and on their relative mobility costs. The following simulations aim at illustrating the likely labour market equilibrium outcomes of such economies.

4.3. Individual Labour Market Performances

As mentioned earlier, we solve the model repeatedly for different combinations of homeownership rates and housing market efficiency defined over the grid $\mu \in]0;100\%[\times \lambda \in]0.3;1[$. Figures 2 to 6 report the results of our simulations. The three-dimensional figures depict the range of homeownership rates and housing market efficiency on the horizontal axes. The vertical axis reports the equilibrium outcome of interest. Each dot in a figure corresponds to a specific μ-λ combination.[17]



(a) Homeowners (b) Renters (c) Ratio

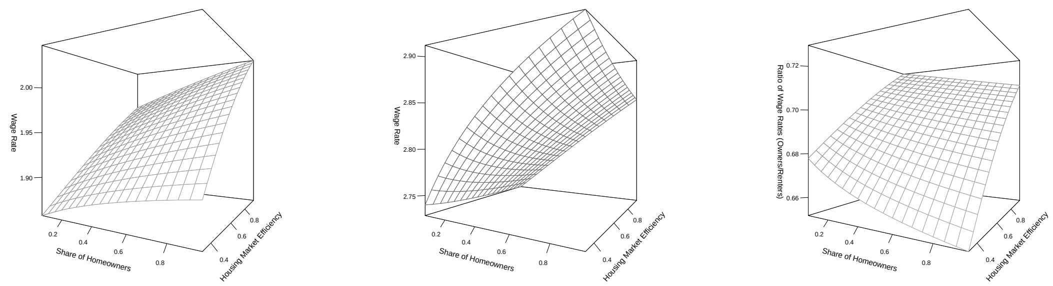
Figure 2: Unemployment Rate

Figure 2 focuses on the equilibrium unemployment rates of homeowners and tenants as we vary the two exogenous variables. First of all, figure 2(c) illustrates the fact that the ratio owner/renter unemployment rates is always superior to unity. Thus, as with most of theoretical papers, we conclude that renters always have lower unemployment rates. Figure 2(a) shows that the unemployment rates of homeowners decrease when their share in the economy increases and, not surprisingly, when their mobility cost decreases due to a frictionless housing market. Tenants also benefit from having proportionately more homeowners in the economy, as shown in figure 2(b). This is a direct consequence of the *entry effect.*

[17]The simulated data are available upon request from the corresponding author.

As in Coulson and Fisher (2009), all workers benefit from new job opportunities induced by the entry of new firms. However, figure 2(c) shows that owners benefit more (the ratio owners/renters unemployment rates decrease) in a frictional housing market whereas the converse holds in a frictionless housing market.[18] This stems from a weaker *competition effect on local labour market* for owners when they are mobile. Figure 2(b) also illustrates the negative consequences of the *competition effect on distant labour markets* on renters' unemployment probability following housing market deregulation. Indeed, their unemployment rate increases as homeowners becomes more mobile.

Figure 3 focuses on average wage rates. It shows that homeowners (Figure 3(a)) and tenants (Figure 3(b)) enjoy better wage rates as the proportion of homeowners increases. Once again, this is a direct consequence of the *entry effect*. Nevertheless, Figure 3(c) also shows that tenants outperform and benefit more than homeowners do because of the *competition effect on local labour markets* (The ratio owner/renter is inferior to unity and always decreasing when owners become more numerous). As expected, increased mobility is once again more beneficial to homeowners (because of the *competition effect on distant labour markets*).



(a) Homeowners

(b) Renters

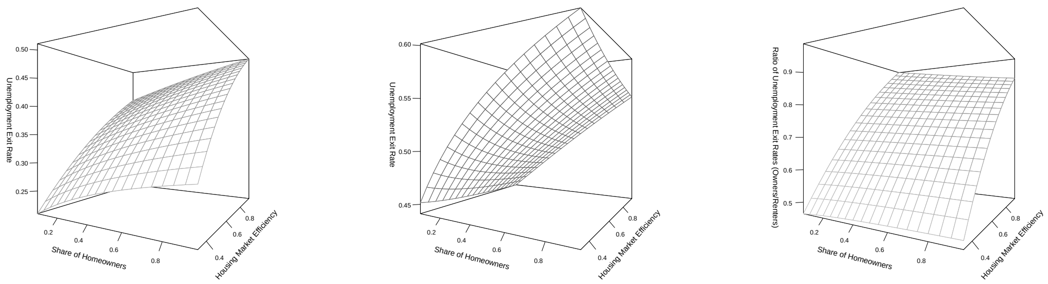
(c) Ratio

Figure 3: Average Wage

Much the same applies to exit rates from unemployment (Figure 4): Increased shares of homeowners is beneficial to everyone, but more so for tenants. Finally, Figure 5 is consistent with the fact that homeowners accept less productive jobs or commute more than tenants

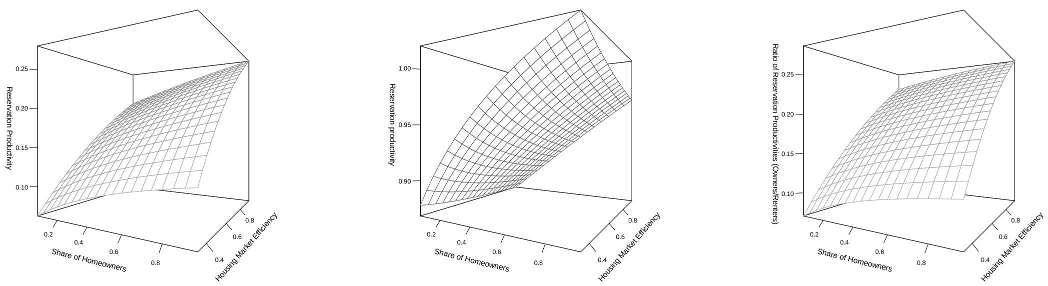
[18]In other words, the unemployment rate of tenants decreases more rapidly as the share of homeowners increases when the latter are sufficiently mobile.

to stay in their local labour market (see equation (14)): Their reservation productivity is everywhere lower. Thus, although they are more mobile within the local labour market, homeowners are less likely to exit unemployment due to their lack of mobility on distant labour markets (See figure 4(c)). As a consequence, and contrary to Munch et al. (2006), we do not find that the job search behavior of homeowners on the local labour market compensates their lack of mobility on distant markets.



(a) Homeowners (b) Renters (c) Ratio

Figure 4: Unemployment Exit Rate



(a) Homeowners (b) Renters (c) Ratio

Figure 5: Reservation Productivity

Our simulations indicate that higher homeownership rates have performance enhancing effects at the individual level. Indeed, both homeowners and tenants are less out of work, earn higher wages and exit unemployment more easily. These positive effects result from both the *entry effect* and the *competition effect on local labour markets*. We are also led to conclude that higher rates of homeownership is more beneficial for tenants. This stems from the *competition effect* in that tenants face less outside competition on each local labour market. Finally, the simulations show that, not surprisingly, enhanced housing market efficiency only benefits homeowners (*competition effect on distant labour markets*).

4.4. Aggregate Labour Market Performances

We now turn to the effects of homeownership policies on aggregate performances. The previous section has shown that homeowners and tenants are usually better off in an economy promoting homeownership. But it has also shown that tenants usually outperform homeowners on the labour markets. Two questions thus need to be addressed: First, is it always the case that artificially increasing the share of (lower-performing) homeowners[19] necessarily leads to worse aggregate performances, in particular to higher aggregate unemployment rates as conjectured by Oswald ? Second, does the latter always hold irrespective of the efficiency of the housing market ? The previous section has focused exclusively on the *entry* and *competition effects.* Here we consider the *composition effect* in addition to the latter two.

4.4.1. Homeownership Rates and Aggregate Unemployment Rates

Figure 6(a) depicts the steady-state relationship between homeownership rates and aggregate unemployment rates. Our model yields a positive relationship as conjectured by Oswald when mobility is costly (low values of λ). However, as the housing market becomes more efficient, the relation flattens out and eventually becomes negative.[20] The non-monotonicity stems directly from mobility costs and thus from housing market conditions. Indeed, when moving is costly due to a frictional housing market, the negative *composition effect* outweighs the *entry* and the *competition* effects. In this case, we come to the same conclusion as Oswald (1997) and Dohmen (2005). However, as the housing market gets more efficient, the search behavior of homeowners and tenants becomes similar so that their labor market performances converge. Hence, for a large enough λ the positive *entry* and *competition* effects more than compensate the negative *composition* effect and we observe a negative correlation between homeownership and unemployment rates. Thus,

[19] We use the term *artificially* to emphasize the fact that homeownership policies encourage some workers to become home owner wihtout change in their job positions or wages.

[20] This occurs for values of λ above 0.6 in our numerical setting. Note that for $\lambda = 0.6$, owners are approximately half as mobile as tenants on distant labour markets.

contrary to Coulson and fisher (2009) who always find a negative correlation, we find that the Oswald's conjecture no longer holds, and may even be inverted, in a frictionless housing market.

Figure 6(a) also shows that the unemployment rate decreases rapidly with λ, the efficiency of the housing market, and more so when the homeownership rate is high. This results from the positive *competition effect on distant labour markets* for homeowners.

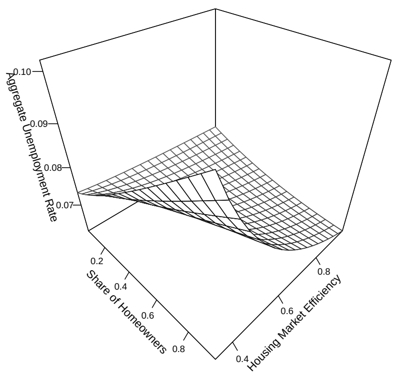
4.4.2. Homeownership Rates and Labour Markets Performances

Figure 6(b) investigates the relation between the aggregate average wage rate and homeownership rates. Recall from Section 3.2 that homeowners are predicted to have a lower wage on average. Not surprisingly then, the figure shows that the average aggregate wage rate declines rapidly with the homeownership rate. In our set-up, the *composition* effect always dominates the *entry* and the *competition* effects on local labour markets. On the other hand, a more efficient housing market will increase homeowners' wages more than it will decrease tenants' wage rates (see Figure 3(c)). Consequently, the aggregate average wage rate will increase as the housing market is made more efficient.

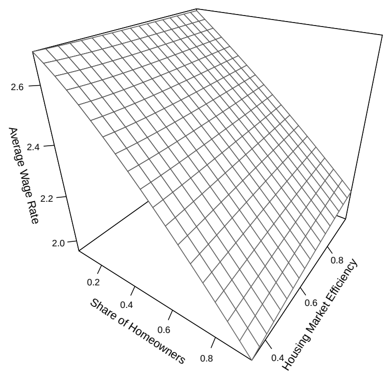
Finally, we report the critical distance in Figure 6(c). It can be interpreted as the share of homeowners who are willing to move to a distant labour market to accept a job. The figure shows that irrespective of λ, fewer move when homeownership rates increase. This stems from the fact that homeowners face less competition from outside job seekers as there are fewer tenants in the economy (*competition effect on local labour market*). In addition, more numerous homeowners will foster additional opportunities on local labour markets (enhanced *entry effect*). As a consequence, homeowners are less motivated to move to find a job when unemployed.

5. Conclusion

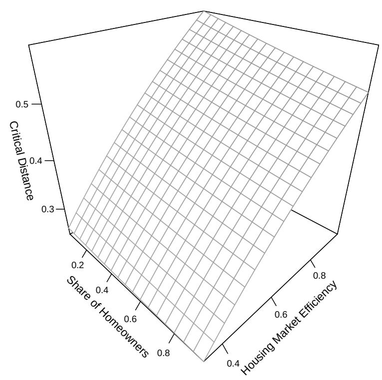
This paper examines the effects of homeownership on labour market performances. In particular, it focuses on the role played by the mobility costs involved by a frictional housing market. Our results show that, while the correlation between homeownership and aggregate labour market performances may be negative, individuals are always better off in an economy in which there are more homeowners. Furthermore, we show that Oswald's conjecture about the negative relationship between aggregate unemployment and homeownership rates may not hold if competition on distant labour markets between homeowners and tenants is



(a) Unemployment Rate



(b) Average Wage



(c) Critical Distance

Figure 6: Aggregate Performances

strong enough. In our economy, such increased competition arises through lower mobility costs that follow housing market deregulation *in fine*.

We reckon that the choice of residential status is exogenous in our economy. In addition, frictions in housing market are introduced so as to entail mobility costs. Future work should attempt to enlarge the housing market effects by endogenizing the tenure choices of workers. However, in its current status, our model is rich enough so that it can identify the conditions under which policymakers would be well advised to stimulate homeownership without leading to detrimental effects on labour market.

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Appendix: Simulated equilibrium equations

At the steady state, the equilibrium of our economy is determined by a system of 8 equations (equations 1A to 8A) with 8 unknowns $(u_h, u_r, \theta, R_h, R_r, \bar{w}_h, \bar{w}_r, \bar{d})$.

We assume a log normal distribution for ε defined on the interval $[0, +\infty[$ with $G(\varepsilon)$ the cumulative density function and $g(\varepsilon) = \frac{dG(\varepsilon)}{d\varepsilon}$ the density function. Due to numerical convergence concerns, we truncate the distribution at a superior born $\varepsilon_{\max}$ large enough so that we have $G(\varepsilon_{\max}) \to 1$. As a consequence, we have:[21]

$$P(\varepsilon_{\max} \geqslant \varepsilon \geqslant R_h) = \int_{R_i}^{\varepsilon_{\max}} \frac{g(\varepsilon)d\varepsilon}{G(\varepsilon_{\max})} = \frac{G(\varepsilon_{\max}) - G(R_i)}{G(\varepsilon_{\max})} = 1 - G(R_i)/G(\varepsilon_{\max}) \to 1 - G(R_i)$$

In what follows, the simulated model is presented given that exogenous truncation.
The flows equations of unemployment rates are:

$$u_h = \mu \frac{\delta}{\bar{d}\theta q(\theta)[1 - G(R_h)/G(\varepsilon_{\max})] + \delta} \tag{1A}$$

$$u_r = (1 - \mu) \frac{\delta}{\theta q(\theta)[1 - G(R_r)/G(\varepsilon_{\max})] + \delta} \tag{2A}$$

where $\theta q(\theta) = \theta^{1-\eta}$.

The reservation productivity of homeowners is given by:

$$R_h = \rho U_h - y = b - y + \beta \frac{\bar{d}\theta q(\theta)}{\rho + \delta} \int_{R_h}^{\varepsilon_{\max}} (\varepsilon - R_h) \frac{dG(\varepsilon)}{G(\varepsilon_{\max})} \tag{3A}$$

[21] When the inferior born is endogenously determined by our model. In the contrary, we have:

$$\int_{R_{i,t}}^{\varepsilon_{\max}} g(\varepsilon)d\varepsilon = \frac{G(\varepsilon_{\max}) - G(R_{i,t})}{G(\varepsilon_{\max}) - G(R_{i,t})} = 1$$

and following an integration by parts we have:

$$R_h = b_h - y + \beta \frac{\bar{d}\theta q(\theta)}{\rho+\delta}\left[(\varepsilon_{\max} - R_h) - \int_{R_h}^{\varepsilon_{\max}} \frac{G(\varepsilon)d\varepsilon}{G(\varepsilon_{\max})}\right]$$

In the same way, we have for the following reservation productivity of tenants:

$$\begin{aligned} R_r &= \rho U_r - y = b - y + \beta \frac{\theta q(\theta)}{\rho+\delta} \int_{R_r}^{\varepsilon_{\max}} (\varepsilon - R_r) \frac{dG(\varepsilon)}{G(\varepsilon_{\max})} \\ R_r &= b_r - y + \beta \frac{\theta q(\theta)}{\rho+\delta}\left[(\varepsilon_{\max} - R_r) - \int_{R_r}^{\varepsilon_{\max}} \frac{G(\varepsilon)d\varepsilon}{G(\varepsilon_{\max})}\right] \end{aligned} \tag{4A}$$

According to the expressions of surplus, the job creation curve is given by:

$$\begin{aligned} \frac{c(\rho+\delta)}{(1-\beta)q(\theta)} &= \phi \int_{R_h}^{\varepsilon_{\max}} (\varepsilon - R_h)\, dG(\varepsilon) + (1-\phi) \int_{R_r}^{\varepsilon_{\max}} (\varepsilon - R_r)\, dG(\varepsilon) \\ \frac{c(\rho+\delta)}{(1-\beta)q(\theta)} &= \phi_t \left[(\varepsilon_{\max} - R_h) - \int_{R_h}^{\varepsilon_{\max}} \frac{G(\varepsilon)d\varepsilon}{G(\varepsilon_{\max})}\right] + (1-\phi_t)\left[(\varepsilon_{\max} - R_r) - \int_{R_r}^{\varepsilon_{\max}} \frac{G(\varepsilon)d\varepsilon}{G(\varepsilon_{\max})}\right] \end{aligned} \tag{5A}$$

where $q(\theta) = A\theta^{-\eta}, \phi = \frac{u_h}{u_h+u_r}, 1-\phi_t = \frac{u_r}{u_h+u_r}$

The average wage of homeowners $\bar{w}_h$ is given by:

$$\begin{aligned} E\left[w_h(\varepsilon)|\varepsilon_{\max} \geqslant \varepsilon \geqslant R_h\right] &= \int_{R_h}^{\varepsilon_{\max}} w_h(\varepsilon) \frac{dG(\varepsilon)}{G(\varepsilon_{\max}) - G(R_h)} \\ &= \int_{R_h}^{\varepsilon_{\max}} \left[\beta\left(y+\varepsilon\right) + (1-\beta)\rho U_h\right] \frac{dG(\varepsilon)}{G(\varepsilon_{\max}) - G(R_h)} \end{aligned} \tag{6A}$$

which gives after an integration by parts:

$$E\left[w_h(\varepsilon)|\varepsilon_{\max} \geqslant \varepsilon \geqslant R_h\right] = \beta y + (1-\beta)\rho U_h + \beta \left[\frac{\varepsilon_{\max} G(\varepsilon_{\max}) - R_h G(R_h) - \int_{R_h}^{\varepsilon_{\max}} G(\varepsilon)d\varepsilon}{G(\varepsilon_{\max}) - G(R_h)}\right]$$

In the same way, the average wage of tenants $\bar{w}_r$ is given by:

$$
\begin{aligned}
E\left[w_r(\varepsilon)|\varepsilon_{\max} \geqslant \varepsilon \geqslant R_r\right] &= \int_{R_r}^{\varepsilon_{\max}} w_r(\varepsilon)\frac{dG(\varepsilon)}{G(\varepsilon_{\max}) - G(R_r)} \\
&= \beta y + (1-\beta)\rho U_r + \beta\left[\frac{\varepsilon_{\max}G(\varepsilon_{\max}) - R_r G(R_r) - \int_{R_r}^{\varepsilon_{\max}} G(\varepsilon)d\varepsilon}{G(\varepsilon_{\max}) - G(R_r)}\right]
\end{aligned} \tag{7A}
$$

with

$$
\begin{aligned}
\rho U_h &= b_h + \beta\frac{\bar{d}\theta q(\theta)}{\rho+\delta}\left[(\varepsilon_{\max} - R_{h,t}) - \int_{R_h}^{\varepsilon_{\max}} \frac{G(\varepsilon)d\varepsilon}{G(\varepsilon_{\max})}\right] \\
\rho U_r &= b_r + \beta\frac{\theta q(\theta)}{\rho+\delta}\left[(\varepsilon_{\max} - R_r) - \int_{R_r}^{\varepsilon_{\max}} \frac{G(\varepsilon)d\varepsilon}{G(\varepsilon_{\max})}\right]
\end{aligned}
$$

Critical distance:

$$
\begin{aligned}
\bar{d} &= \lambda\left\{\frac{\beta}{\rho+\delta}\int_{R_h}^{\varepsilon_{\max}} (\varepsilon - R_h)\frac{dG(\varepsilon)}{G(\varepsilon_{\max})} - G\left(R_h\right)U_h\right\} \\
&= \lambda\left\{\frac{\beta}{\rho+\delta}\left[(\varepsilon_{\max} - R_h) - \int_{R_h}^{\varepsilon_{\max}} \frac{G(\varepsilon)d\varepsilon}{G(\varepsilon_{\max})}\right] - G\left(R_h\right)U_h\right\}
\end{aligned} \tag{8A}
$$